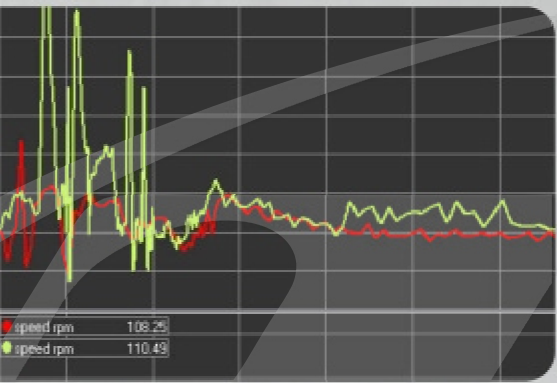
Racing Data Power

GPS MODULE

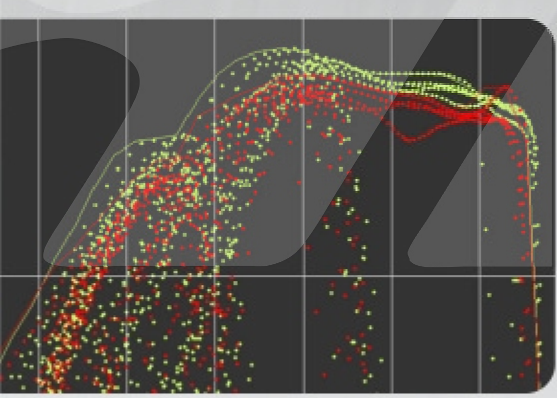
A REVOLUTION IN YOUR KART TECHNICAL ANALYSIS

ON-TRACK SESSIONS



PROFESSIONAL ANALYSIS

Of chassis and engine



A WINNING TOOL

To enhance your performance
and optimize kart set-up

Date: 28 February 2007

Pista: Ottobiano (PV, Italy)

Kart: Birel Easy Kart 60cc

Engine: IAME Easy Kart 60cc

Instrumentation:
MyChron4 + GPS Module

DYNAMIC ANALYSIS

RELEASE 1.02

Introduction

The data we are going to analyse refer to a sprint race chassis with a 60 cc engine and a 18mm restrictor installed on the exhaust as provided by the regulations.

The difficulties of kart setup depend on the limited engine power available, that makes the correct setup difficult to reach.

In the following pages we are going to analyse the best lap of three different runs. First one is in red, second one is in light blue and third one is in green.

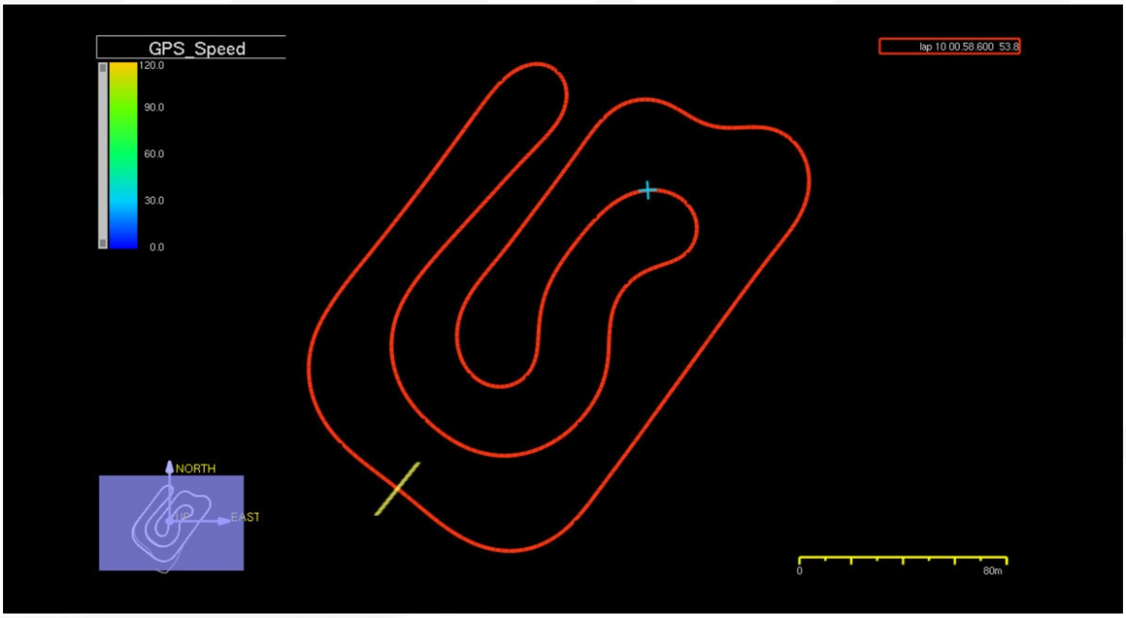
Loggers: MyChron 4 + GPS Module

It's worth saying that during the day session chassis, engine and sprocket were not changed.

All modifications were made on setup and engine tuning (carburation and exhaust system).

Track

The session took place at Ottobiano track (near to Pavia, in the north of Italy) and track map made through GPS signals is here below.

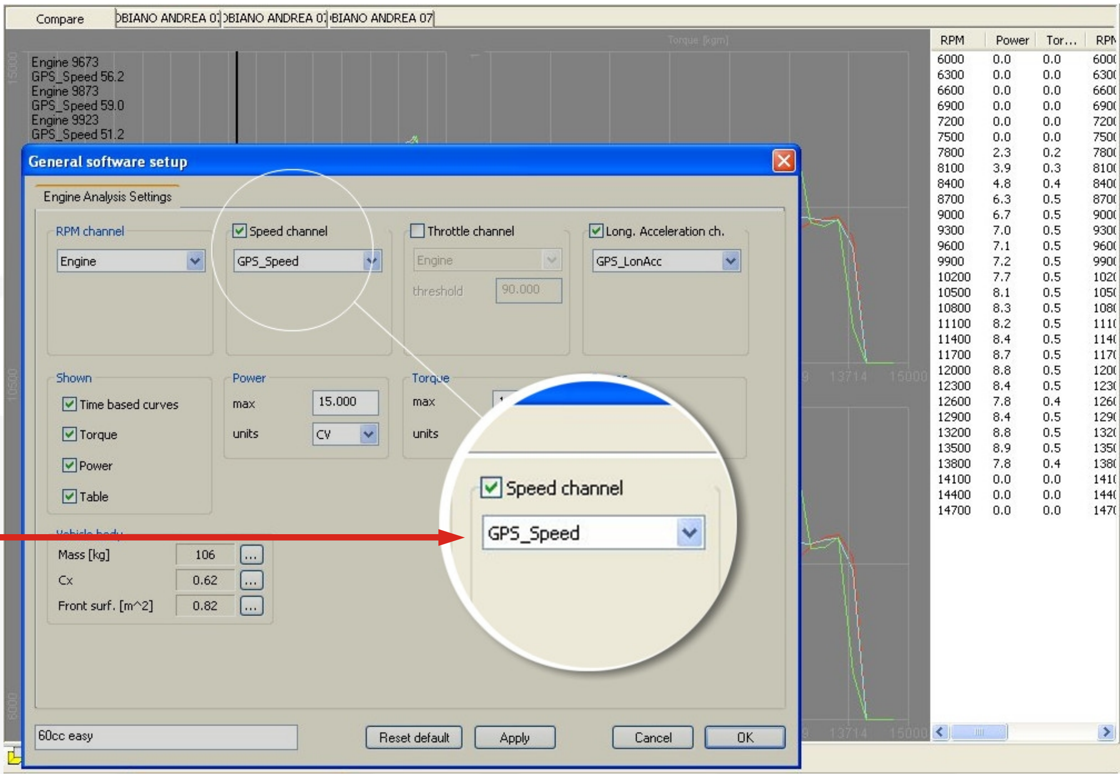


Picture 1

Engine Analysis

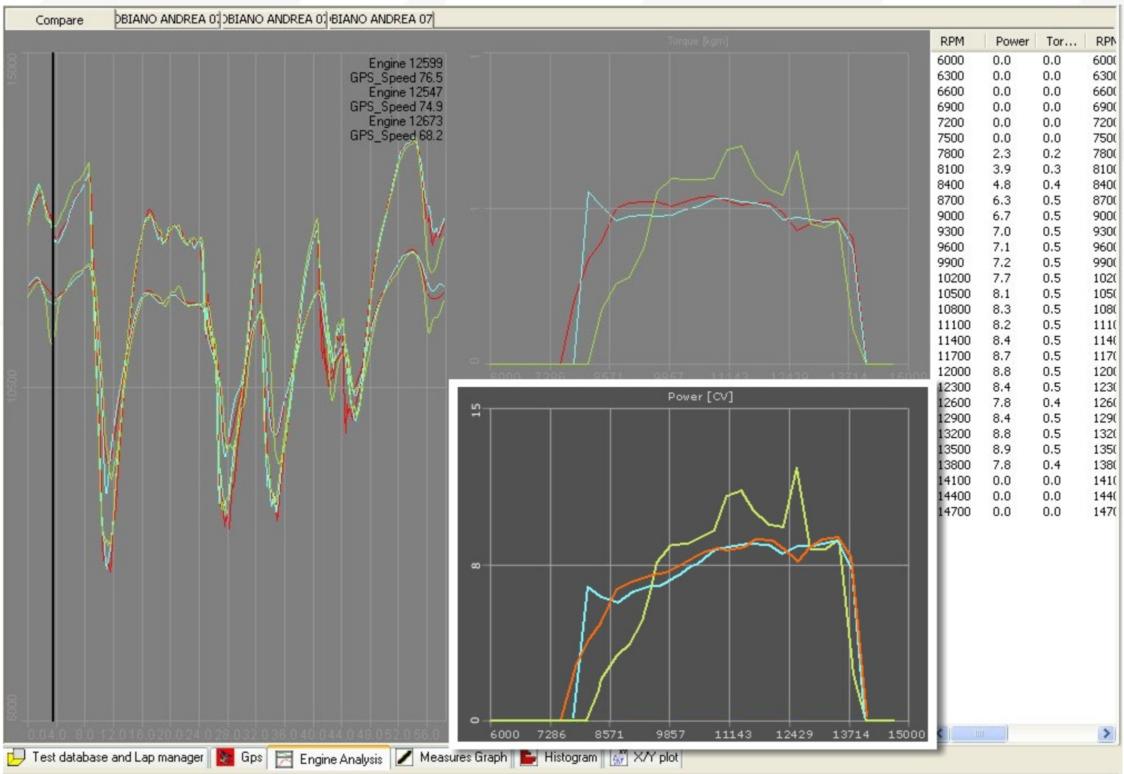
With reference to the picture 2, please activate engine analysis in Race Studio Analysis software and set GPS-speed, that is not influenced by tyre consumption nor by the position the sensor is installed in (internal or external to the corner), as reference speed.

GPS speed



Picture 2

The result is:



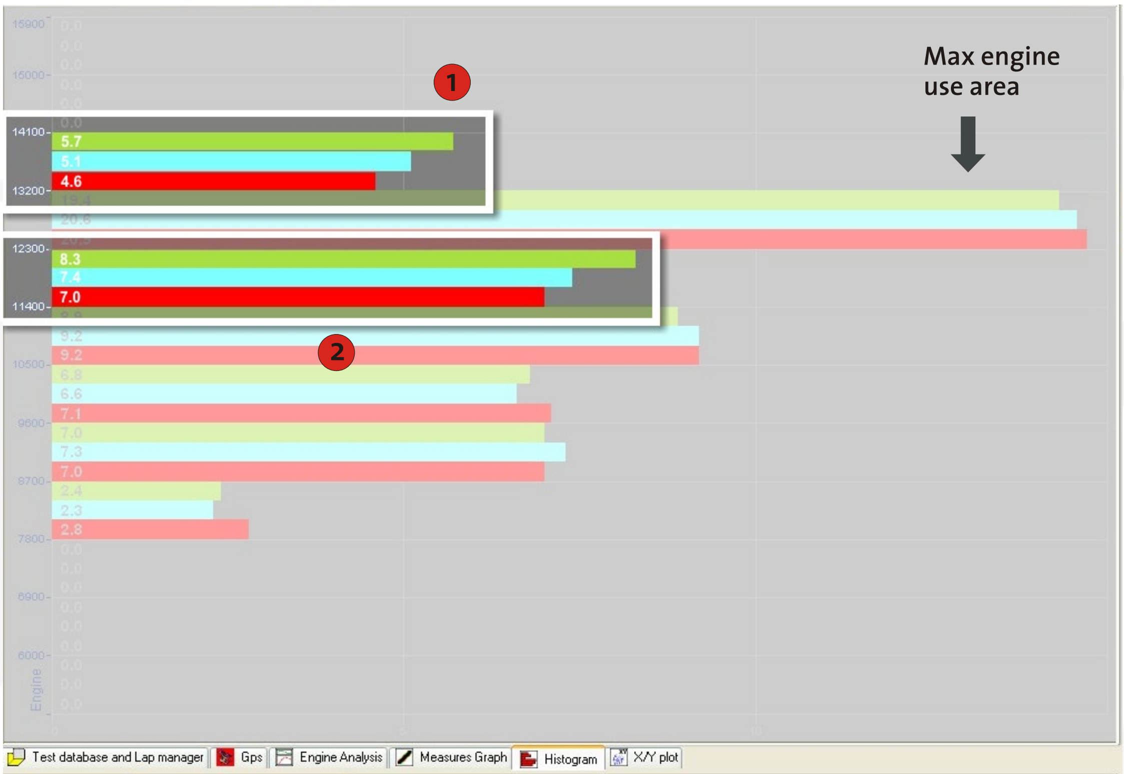
Picture 3

The run in green shows an evident improvement of engine performances due to an optimum carburation as well as a different exhaust pipe length. We remind you that the longer the exhaust pipe the more the lower RPM engine torque and vice versa.

Using the tools Race Studio 2 provides we can confirm what highlighted by the previous graph.

This can be done through RPM histogram window.

Looking at 13200-14100 RPM range 1 , we can notice that engine use percentage grew from 4,6% (red) to 5,7% (green).



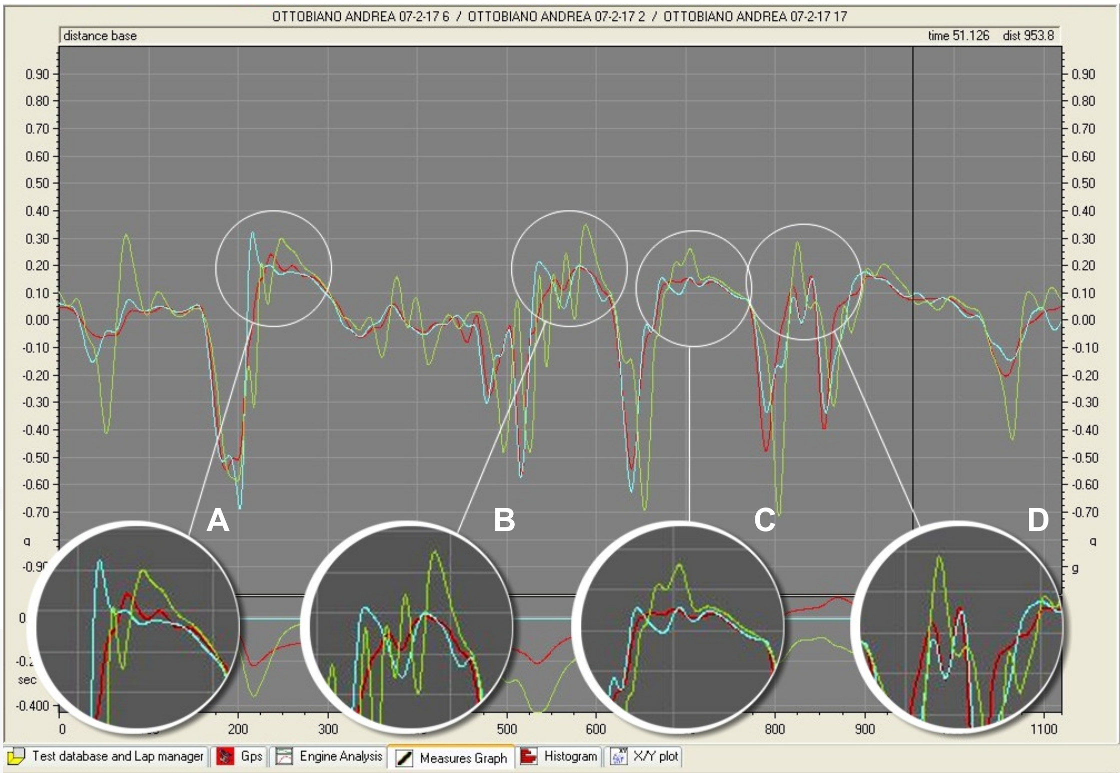
Picture 4

Always with reference to the green lap, percentage of use between 11.400 and 12.300 RPM increased as well 2 .

Being that the power curve in green shows a bending between 12.300 and 13.200 RPM value, the range where the engine is more used, a further modification on the engine should lay to a greater linearity of the graph (to avoid graph bendings).

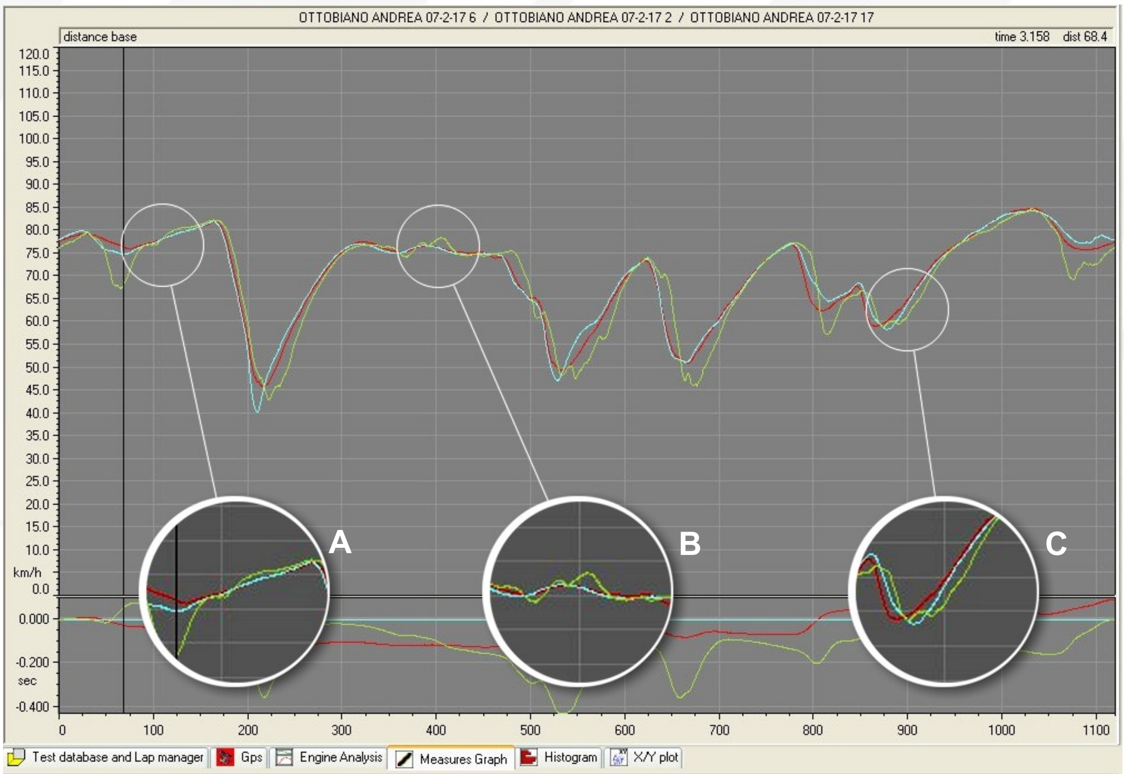
The improvement of the performances of the lap in green is shown by the graphs of longitudinal accelerations calculated by **GPS MODULE** too.

In the picture 5 you can see how in points A, B, C and D acceleration passed from a 0,20 g peak value for the other two laps to 0,30 g for the green one.



Picture 5

Speed graphs too (in points A, B and C) confirm what the previous analysis highlighted.



Picture 6

Looking at point C: the speed exiting the corner of the green graph is lower but its higher rapidity in increasing RPM takes this difference to zero in a few metres.

Chassis Analysis

Thanks to **GPS MODULE**, we can make a chassis analysis to reach the optimum tuning of the vehicle.

The considerations here below are only examples: the same hypothesis can be confirmed in other ways.

In the analysis we added a math channel defined as:

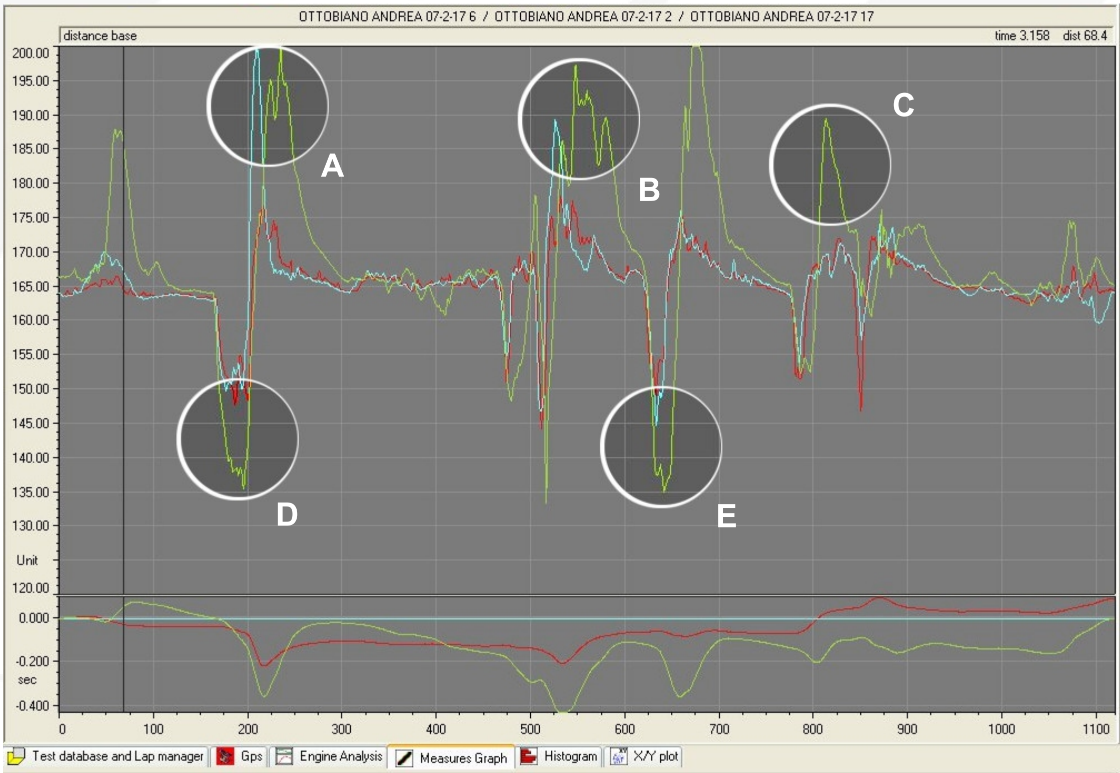
Slip=engine/GPS_Speed

This channel needs an explanation.

Apparently very simple (it's a fraction), the calculated value defines the difference of behaviour between the vehicle speed and the speed of the only rear wheels (that is directly proportional to the number of engine RPM due to the fact that the kart engine is one stroke).

During braking, for example, the vehicle runs more metres than the wheel locking should allow and the value diminishes if compared to the calculation obtained on the straight and without wheels slips.

In the figure 7 points A, B, and C show a slip of rear wheels while points D and E shows a locking of the same wheels during braking.

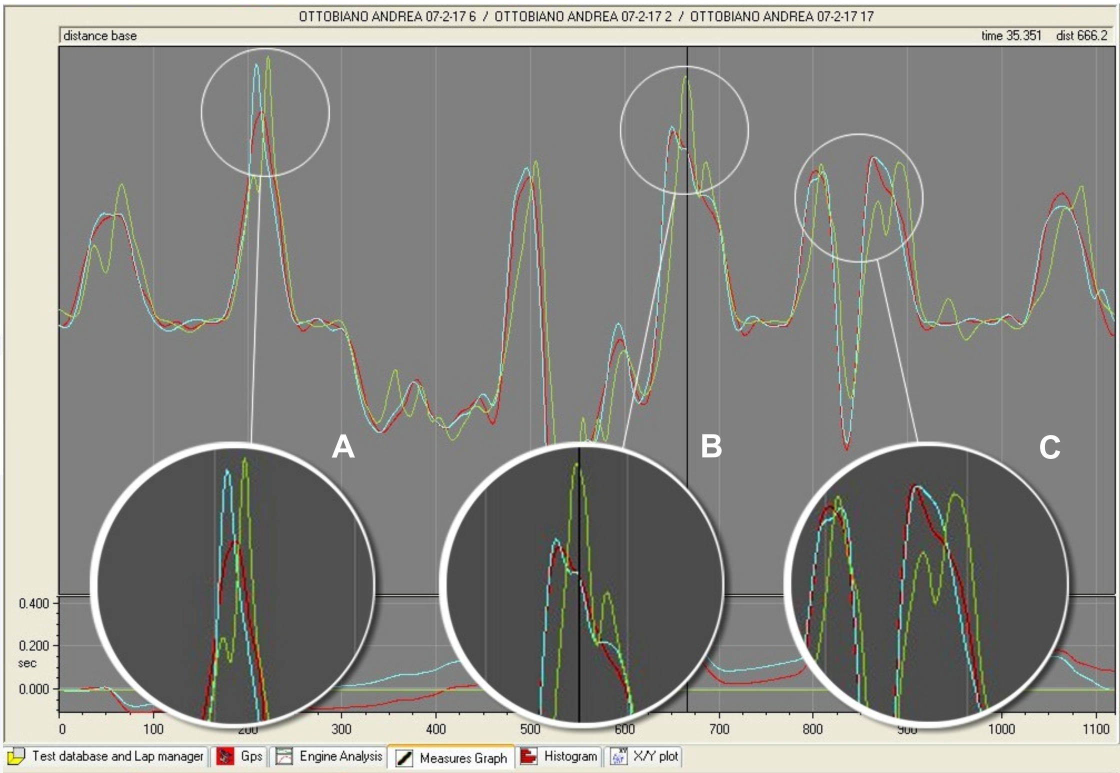


Picture 7

Looking at peak values in points A, B and C exiting the corner, we can see how the green line shows an higher slip of the rear axle if compared to light blue setup (intermediate) and red one (higher grip). In the same way low peaks of the graph in points D and E indicates how the chassis leans to lock more the rear axle during braking in the green setup than in the red or in the light blue one.

It is important to notice that GPS speed is absolute and thereby has no reading errors due to tyre crawling on the asphalt.

Let's now analyse GPS_Gyro channel graph. This channel measures the angular yawing angle speed and indicates the capacity of the chassis to run a certain line. Another aspect that comes out is that the green graph comes out to be right shifted if compared to the other.

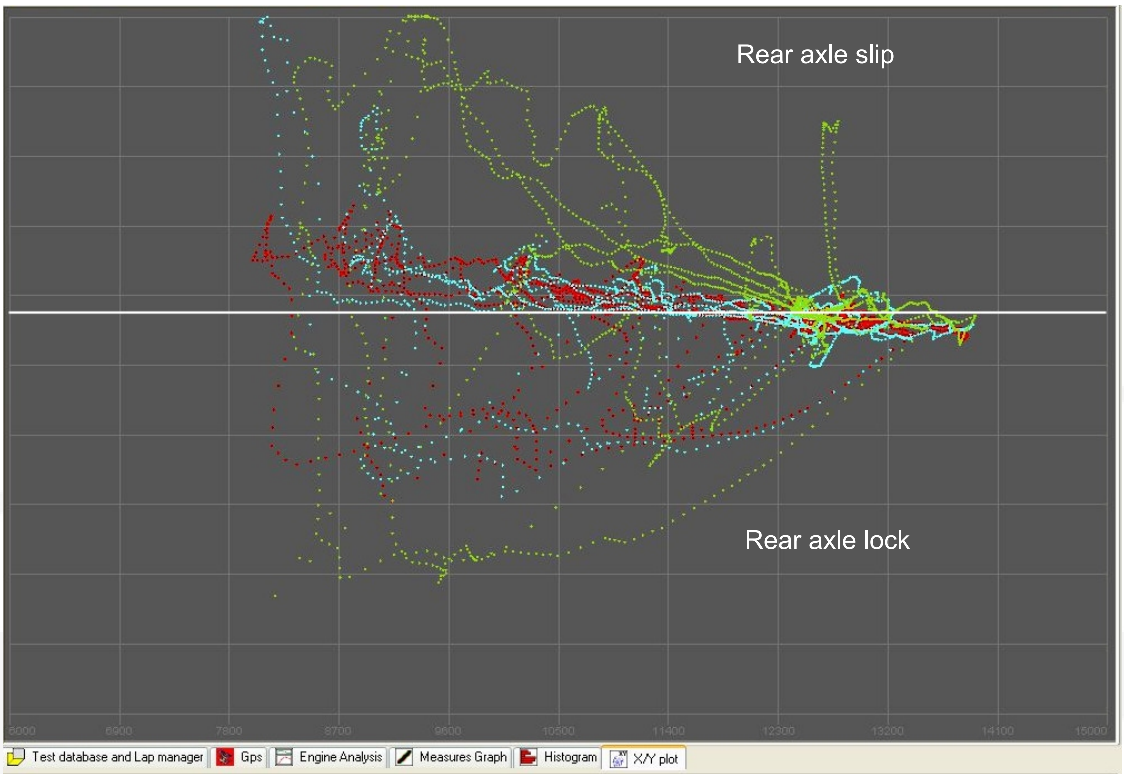


Picture 8

This indicates how the slip we saw before is generated by an initial under steering of the chassis entering the corner: the front axle slips until when the grip between front wheels and asphalt is suddenly restored causing a lack of balance to the rear axle that starts slipping loosing its grip.

A confirm of what said until now is in the XY graphs that show RPM on X axle and SLIP channel on Y axle.

You can clearly see how the green scatter plot is a lot wider and spread while the red one is more restricted.

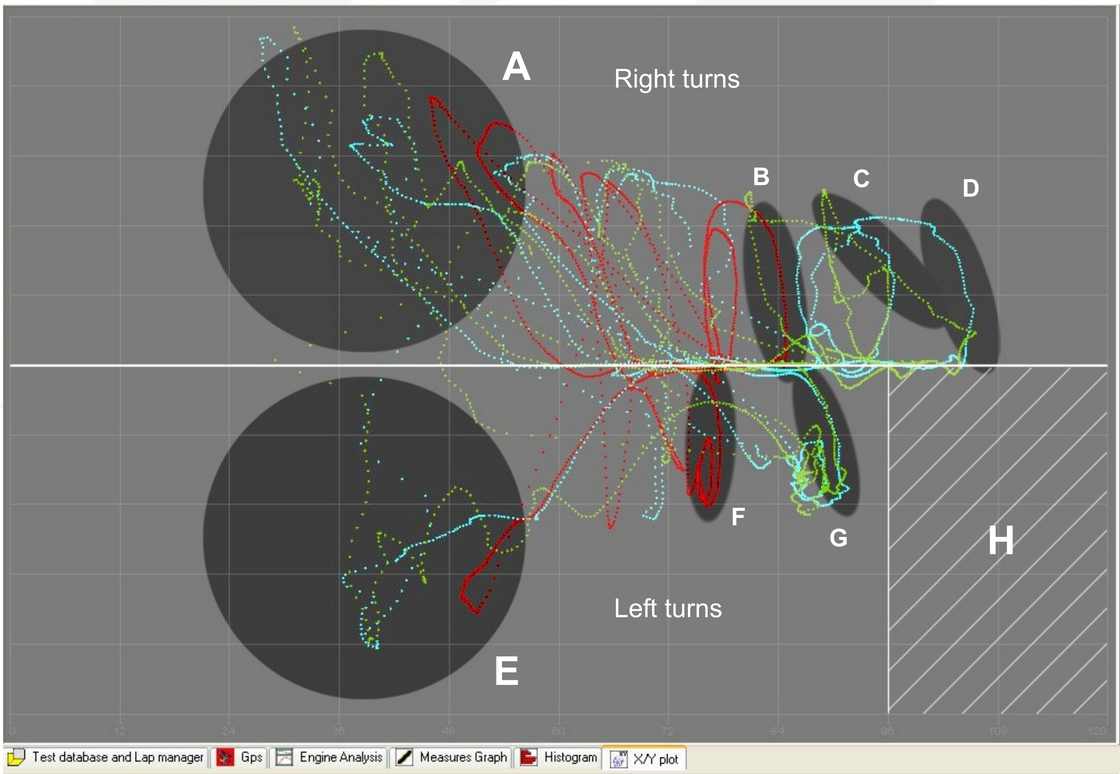


Picture 9

Please note: considering that we are speaking of a 60cc chassis, we should obtain the right compromise between road holding and low engine power.

In effect an excessive grip causes a load to the engine that can no more push the kart over.

Always using an XY graph (X=RPM, Y=GPS_Gyro), we can confirm what said before.



Picture 10

The picture 10 shows two important elements:

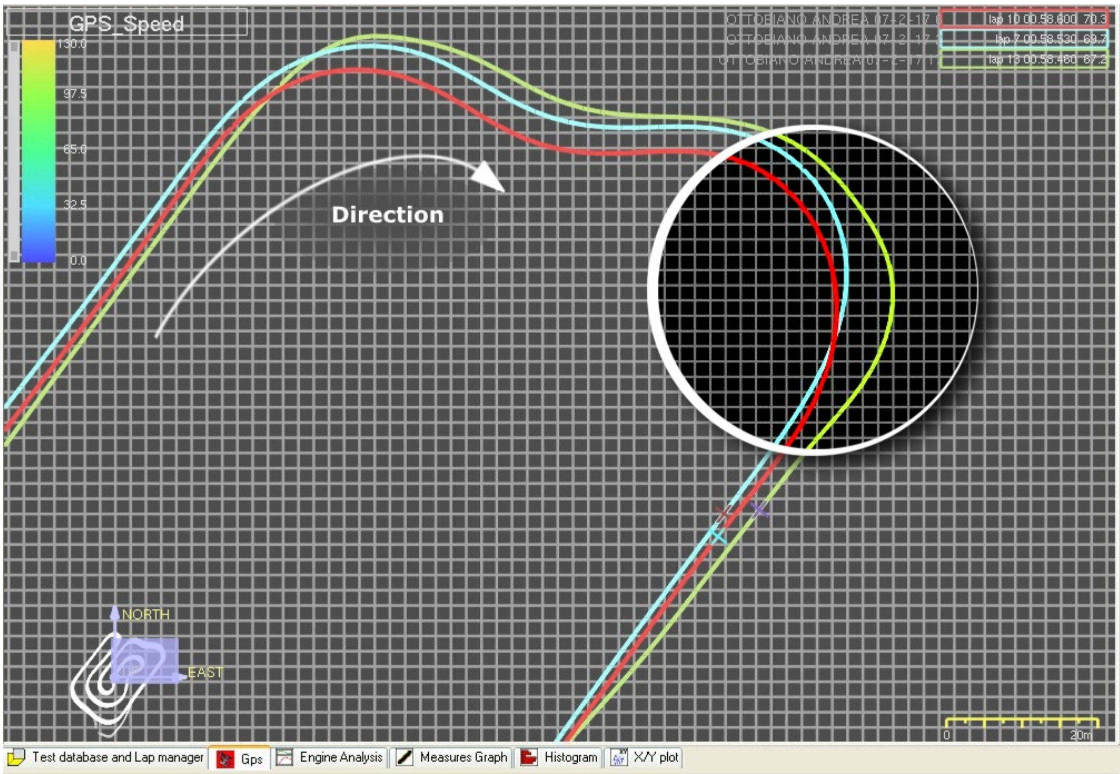
1) An asymmetry in the chassis behaviour if looked in respect of the centre line highlighted in the figure.

   Having the track a lot more right than left corners, upper part of the graphs is of course different from lower one: H area, sketched, is characterised by the lack of fast left corners.

   In spite of this, a visual analysis of the tyres shows a difference of reaction in the left corners. This is highlighted in A and E round areas described by right corner and left corner having a similar radius.

2) The fast advancing face of the light blue and red scattering plot in points B (red) and D (light blue) if compared to C area (green) demonstrates the under steer in the green run if compared to the others in right corners, while in left corners (points F and G) we can notice more uniformity of behaviour between the different setups.

Finally, thanks to GPS, we can see the line of the kart on the track (picture 11).



Picture 11

The green line clearly shows how the driver braked late and run more track metres.

This is easily intuitable the green setup making the kart slipping more and being more difficult to drive.

Conclusions

The three analysed lap times are:

RED	58,600 seconds
BLUE	58,530 seconds
GREEN	58,460 seconds

Also if lap times are very similar the differences that came out are a lot.

Best chassis setup is the light blue one, with the right compromise between grip, speed and low engine power.

Best engine tuning is the green one: in spite of the curve error, lap time is better because the engine can make the difference in performance.

In conclusion the engine seems to be the most important thing for lap times.

In reality, from a race point of view, what is important is the chassis: the harder thing to do is not only a good lap time but a steady race rhythm on 15-20laps.

With the green setup there is unavoidably an unacceptable tyres performances decline that takes the driver to run a defensive race.

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AIM Sportline - The World Leader in Data Acquisition

Tel. +39.02.9290571 - info@aim-sportline.com